REMARKS

Claims 1-5 and 7-48 are in the application. New Claims 47 and 48, which depend from Claims 1 and 24, respectively, are added to specify that each nanopore contains one molecule; see, for example, paragraphs 0005 and 0035 regarding basis for these claims.

The Examiner is correct in his assumption that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made.

Claims 1-2, 5, 7, 8, 10-13, and 23 are rejected under 35 USC 103(a) as being unpatentable over Kikuchi et al (U.S. Patent 6,379,572) in view of Deckman et al (U.S. Patent 4,407,695).

The Kikuchi et al reference was discussed in Applicants' previous Amendment filed July 30, 2003. The remarks and arguments made therein obtain here as well.

Deckman et al, newly cited, disclose a natural lithographic fabrication of microstructures over large areas. Large area random and mosaic arrays of identical submicron microcolumnar structures can be produced on surfaces by directionally ion etching a monolayer film of spherical colloidal particles.

Applicants' Claim 1 recites a method for forming at least one nanopore for aligning at least one molecule for molecular electronic devices or for forming a mold for deposition of a material. The method comprises:

(a) providing a substrate having a first major surface and a second major surface, substantially parallel to the first major surface;

(b) forming an etch mask on the first major surface, the etch mask comprising at least one nanoparticle;

(c) directionally etching the substrate from the first major surface toward the second major surface, using the etch mask to protect underlying portions of the substrate against the etching, thereby forming at least one pillar underneath the etch mask, wherein the directional etching is carried out by reactive ion etching;

(d) forming a layer of insulating material on the etched substrate, including around the pillar(s) and at least partially covering the pillar(s); and

(e) removing the pillar(s) to leave at least one nanopore in the insulating layer.

Claims 2, 5, 7, 8, 10-13, and 23 depend, directly or indirectly, from Claim 1.

The Examiner essentially argues that the process of Kikuchi et al, which is directed to making microscale holes, could be modified by the process of Denkman et al, which is directed to making microcolumnar posts, or pillars. The Examiner admits that Kikuchi et al do not discuss utilizing nanoparticles and do not discuss reactive ion etching. The Examiner cites Denkman et al for its purported showing of directional ion etching to form microcolumnar structures that are as small as 50 Å, citing Col. 6, line 29.

The Examiner appears to be suggesting that a process for making microscale pores can be combined with a process for making solid nanoscale pillars, and that this combination somehow discloses Applicants' method for forming nanopores for aligning at least one molecule for molecular devices or for forming a mold for deposition of a material therein.

The Examiner appears, however, to have lost sight of Applicants' method. The Examiner argues on page 6 of the Office Action that it would have been obvious to one of ordinary skill in the art to have modified Kikuchi et al by utilizing nanoparticles of a particular size that will produce holes of a particular size and reactive ion etching as taught by Denkman et al "because it allows for producing a large area lithographic mask on the surface of the substrate".

First, the holes of Kikuchi et al are only a controlled ("particular") size if the nanoparticles form a perfectly uniformly spaced array. In direct contrast, Applicants' claimed method does not require a uniform packing of the nanoparticles to obtain a uniform pore size.

Second, Applicants are not claiming a process for producing a large area lithographic mask. Kikuchi et al disclose the fabrication of a flat panel display with spaced apart gate emitter openings. Denkman et al disclose the fabrication of submicron microcolumnar structures. Neither reference discloses or even remotely suggests a method for forming at least one nanopore for aligning at least one molecule therein. Consequently, the combination utterly fails to suggest such a method.

The test for obviousness is not whether the Examiner can find bits and pieces of Applicants' method disclosed in the references, using Applicants' own disclosure for guidance. The test, rather, is whether there is some teaching, suggestion, or incentive supporting the combination. There is no disclosure or suggestion in either reference of the desirability of combining the references. Indeed, the Examiner is attempting to combine the teachings of a reference directed to forming gate emitter ***openings*** with a reference directed to forming microcolumnar structures (***pillars***). Even if the references are combined, the combination fails to disclose or suggest Applicants' method for forming at least one nanopore for aligning at least one molecule therein.

Specifically, neither reference is directed to forming nanopores for aligning molecules therein or for forming a mold for deposition of a material therein.

Reconsideration of the rejection of Claims 1-2, 5, 7, 8, 10-13, and 23 under 35 USC 103(a) as being unpatentable over Kikuchi et al in view of Denkman et al is respectfully requested.

Claims 3, 21, and 22 are rejected under 35 USC 103(a) as being unpatentable over Kikuchi et al, *supra*, in view of Denkman et al, *supra*, as applied to Claims 1-2, 5, 7, 8, 10-13, and 23 above, and further in view of Hatakeyama et al (U.S. Patent 6,010,831).

Kikuchi et al and Denkman et al are discussed above. The Hatakeyama et al reference was discussed in Applicants' previous Amendment filed July 30, 2003. The remarks and arguments made therein obtain here as well.

Applicants' Claims 3, 21, and 22, which depend directly or indirectly from Claim 1, specify the size of the nanoparticle (Claim 3) and the dimensions of the nanopore (Claims 21 and 22).

The arguments made above regarding the first two references obtain here as well. The Examiner is attempting to add to the combination the Hatakeyama et al reference without regard to its teachings. As argued in Applicants' previous Amendment, Hatakeyama et al disclose a process for making solid nanoscale cones. Topologically, the cones of Hatakeyama et al and the pillars of Denkman et al are the same. Thus, the Examiner appears to be suggesting that a process for making microscale pores can be combined with processes for making solid cones and pillars, and that this combination somehow discloses Applicants' method for forming nanopores for aligning at least one molecule for molecular devices or for forming a mold for deposition of a material therein.

Again, the test for obviousness is not whether the Examiner can find bits and pieces of Applicants' method disclosed in the references, using Applicants' own disclosure for guidance. The test, rather, is whether there is some teaching, suggestion, or incentive supporting the combination. There is no disclosure or suggestion in either reference of the desirability of combining the references. Indeed, the Examiner is attempting to combine the teachings of a reference directed to forming gate emitter ***openings*** with references directed to forming microcolumnar structures (***pillars***) and solid nanoscale ***cones***. Even if the references are combined, the combination fails to disclose or suggest Applicants' method for forming at least one nanopore for aligning at least one molecule therein. Specifically, neither reference is directed to forming

nanopores for aligning molecules therein or for forming a mold for deposition of a material therein.

The Examiner appears to be suggesting that nanoparticles of a particular size are identical to nanopores of a particular size. This is not accurate. A particle does not necessarily produce a pore of the identical size, and a nanoparticle does not necessarily produce a nanopore of the identical size. Further, a nanoparticle is matter, and a nanopore is the absence of matter.

In addition to the foregoing, the Examiner is attempting to combine a reference that is silent as to the use of any beam as part of the process (Kikuchi et al) with a first reference that teachings reactive ion etching (Denkman et al) and with a second reference that teaches use of an energy beam with a reactive gas particle beam, wherein the energy beam is a fast atomic beam (FAB). This approach by the Examiner is indulging in the impermissible act of selecting bits and pieces of prior art, based on Applicants' own claims, to reject the application, without regard to the teachings of the references as a whole.

Reconsideration of the rejection of Claims 3, 21, and 22 under 35 USC 103(a) as being unpatentable over Kikuchi et al in view of Denkman et al further in view of Hatakeyama et al is respectfully requested.

Claims 9, 14-20, 24-26, and 28-46 are rejected under 35 USC 103(a) as being unpatentable over Kikuchi et al, *supra*, in view of Denkman et al, *supra*, and further in view of Hatakeyama et al, *supra*, and further in view of Jun (U.S. Patent 5,393,373).

Kikuchi et al, Denkman et al, and Hatakeyama et al are discussed above. The Jun reference was discussed in Applicants' previous Amendment filed July 30, 2003. The remarks and arguments made therein obtain here as well.

Claims 9 and 14-20 depend, directly or indirectly, from Claim 1. Independent Claim 24 recites a method for forming at least one molecule in a pre-selected orientation relative to a substrate. The method comprises: (a) forming at least one nanopore (employing the method of Claim 1); and (b) dispersing at least one molecule in at least one nanopore. Claims 25, 26, and 28-46 depend, directly or indirectly, from Claim 24.

The Examiner argues that Jun et al teach depositing insulation material by CVD (relevant to Applicants' Claim 9) and filling the valleys with material (relevant to Applicants' Claims 14-20).

However, the combination of Kikuchi et al and Hatakeyama et al has been shown above to be flawed, and hence the combination of Kikuchi et al with Hatakeyama et al and Jun et al likewise falls.

With regard to independent Claim 24, that claim recites a method for forming at least one molecule in a pre-selected orientation relative to a substrate. The method comprises:

(a) forming at least one nanopore by:

(1) providing the substrate having a first major surface and a second major surface, substantially parallel to the first major surface,

(2) forming an etch mask on the first major surface, the etch mask comprising at least one nanoparticle,

(3) directionally etching the substrate from the first major surface toward the second major surface, using the etch mask to protect underlying portions of the substrate against the etching, thereby forming at least one pillar underneath the etch mask,

(4) forming a layer of insulating material on the etched substrate, including around the pillar(s) and at least partially covering the pillar(s), and

(5) removing the pillar(s) to leave at least one nanopore in the insulating layer; and

(b) dispersing at least one molecule in each nanopore.

Jun et al are totally silent on the concept of filling their valleys with at least one molecule. The Examiner contends that this reference teaches depositing material in the valleys, which the Examiner equates to Applicants' nanopores. The material (dielectric layer 16 and polysilicon layer 17) is actually used to coat the upper surface of polysilicon layers 24 and 27 to produce a capacitor. A process for depositing a dielectric ***layer*** and a polysilicon ***layer*** in a valley hardly suggests disposing at least one ***molecule*** in a nanopore. Is the Examiner suggesting that a crystalline or polycrystalline material is equivalent to a molecule?

Accordingly, Claim 24, together with Claims 25-26 and 28-46, are clearly patentable over the combination of references.

The Examiner argues on pages 8-9 of the Office Action that Jun et al teach the manufacture of ***semiconductor*** devices. In direct contrast, Applicants' claims are directed to ***molecular*** devices, not semiconductor devices. Applicants' method claims recite a method for forming at least one nanopore for aligning at least one molecule for molecular electronic devices (Claim 1) and a method for forming at least one molecule in a pre-selected orientation

relative to a substrate (Claim 24). Applicants are specifically interested in a molecular device where the enabling material is the molecule. This is vastly different than a semiconductor device. Any two terminal device must have two contacts. This does not make semiconductor devices equivalent to molecular devices. Indeed, resistors, capacitors, and inductors each have two terminals, and no one would say that they are equivalent to each other.

The Examiner argues on page 9 of the Office Action that the "motivation for utilizing CVD to deposit the insulating material, depositing material in the nanopore, utilizing an electrical substrate of doped polycrystalline silicon, a tunnel barrier layer and the material being semiconductive is that it allows for the production of a semiconductor device."

Applicants can find no mention of a tunnel barrier in the references cited, and would appreciate it if the Examiner would specifically cite the location in the reference(s) where a tunnel barrier is mentioned. In the absence of such citation, Applicants urge that at least Claims 19 and 42 are patentable over the references. Jun et al discloses a capacitive device; tunneling would destroy such a device, since it would no longer function as a capacitor. Thus, the teachings of Jun et al are ***contrary*** to Applicants' claims. Furthermore, while Jun et al may imply barriers, this does not mean that these barriers are tunneling. Instead, such barriers of Jun et al are intended to ***prevent*** tunneling. Although any barrier has some finite probability of tunneling, any tunneling of Jun et al would occur over a time period of many years, which would not provide a useful device based on tunneling.

Reconsideration of the rejection of Claims 9, 14-20, 24-26, and 28-46 under 35 USC 103(a) as being unpatentable over Kikuchi et al in view of Hatakeyama et al and further in view of Jun is respectfully requested.

Claims 4 and 27 are rejected under 35 USC 103(a) as being unpatentable over Kikuchi et al, *supra*, in view of Denkman et al, *supra*, and further in view of Hatakeyama et al, *supra*, and further in view of Jun, *supra*, and further in view of Brandes et al (U.S. Patent 5,900,301).

Kikuchi et al, Denkman et al, Hatakeyama et al, and Jun et al are discussed above. Brandes et al disclose the structure and fabrication of electron-emitting devices utilizing electron-emissive particles which contain carbon.

Applicants' Claim 4 depends from Claim 1 and recites the structure of the nanoparticle(s) used in the method of Claim 1, namely, an inorganic crystalline core covered with an organic layer.

The Examiner argues that Brandes et al teach applying carbon particles for etching and that the particles are applied though an organic solvent.

Applicants have shown above that the combination of Kikuchi et al and Hatakeyama et al falls with respect to amended Claim 1. Accordingly, the combination of Kikuchi et al, Hatakeyama et al, Jun et al, and Brandes et al also falls.

The Examiner also seems to be suggesting that carbon particles suspended in an organic solvent are somehow equivalent to Applicants' inorganic crystalline core covered with an organic layer. Applicants' inorganic core and organic shell are essentially a unit, used as the nanoparticle to form the nanopore. As is evident from Applicants' paragraph 0021, the organic layer does not serve to suspend the particles in the liquid (as taught by Brandes et al). Rather, the function of the organic layer is to keep the inorganic cores from touching and joining. In some cases, the particles do not have an organic coating. They still function the same, but the particles do not stay in suspension as long and need to be kept under specific conditions, for example, refrigerated. Thus, the organic coating is not critical; it only makes the process more robust.

The Examiner argues on page 10 of the Office Action that the "motivation for utilizing a particle that is inorganic coated with an organic is that it allows for developing pillars when anisotropic etching takes place".

Applicants fail to see the Examiner's logic. Coating the inorganic core with an organic material does not seem to have anything to do with developing pillars when anisotropic etching is used. Further, it is not obvious how a carbon particle suspended in a solvent teaches an inorganic particle surrounded by an organic (solid) material.

Applicants' Claim 27, which is analogous to Claim 4, depends from independent Claim 24. As shown above, the combination of Kikuchi et al, Hatakeyama et al, and Jun et al utterly fails to disclose or even remotely suggest a method for forming a molecule in a pre-selected orientation relative to a substrate, as recited in Claim 24. Accordingly, the combination of Kikuchi et al, Hatakeyama et al, Jun et al, and Brandes et al also falls.

Reconsideration of the rejection of Claims 4 and 27 under 35 USC 103(a) as being unpatentable over Kikuchi et al in view of Hatakeyama et al and further in view of Jun and further in view of Brandes et al is respectfully requested.

The Examiner appears to argue on page 10 that Denkman et al suggests the formation of pores. Clearly, Denkman et al utterly fail to suggest pores, and the Examiner is simply in error

on this argument. All Denkman et al suggest is the formation of pillars. The Examiner is reading far more into this reference than is warranted.

The Examiner also argues on page 10 that the process of Jun et al "would necessarily deposit at least one molecule in a nanopore if the substrate had a nanopore and if the deposition process was carried out thereon." This argument by the Examiner is totally without justification and support. The process of Jun et al has nothing to do with molecules and everything to do with capacitors. Further, not one of the references cited by the Examiner discloses or even remotely suggests orienting molecules in nanopores. The Examiner's argument is clearly, and impermissibly, based on using Applicants' claims to construct a facsimile of their invention, using bits and pieces from various references that have nothing at all to do with molecular devices.

Finally, none of the references cited by the Examiner deal with forming nanopores in which each nanopore contains a single molecule, as recited in new Claims 47 and 48. The cited references fail to even remotely suggest such a configuration. Thus, at the very least, Claims 47 and 48 must be deemed patentable over any combination of the cited references.

The foregoing amendments and arguments are submitted to place the application in condition for allowance. The Examiner is respectfully requested to take such action. If the Examiner has any questions, he is invited to contact the undersigned at the below-listed telephone number. HOWEVER, ALL WRITTEN COMMUNICATIONS SHOULD CONTINUE TO BE DIRECTED TO: IP ADMINISTRATION, LEGAL DEPARTMENT, M/S 35, HEWLETT-PACKARD COMPANY, P.O. BOX 272400, FORT COLLINS, CO 80527-2400.

Respectfully submitted,

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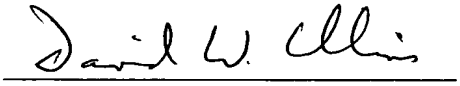

David W. Collins
Reg. No. 26,857
Attorney for Applicants

75 West Calle de las Tiendas
Suite 125B
Green Valley, AZ 85614

Telephone calls may be made to:
(520) 399-3203